Controllable pitch propeller solutions
Propulsion solutions with Lips controllable pitch propellers

Wärtsilä designs and produces controllable pitch propellers for the commercial, military and superyacht market. It is a unique product, the first design for which dates back to 1903. With this wealth of experience and more than 10,000 installations installed and sailing worldwide, we present in this brochure our latest innovative designs.

A LIPS® controllable pitch propeller installation consists of a hub, propeller blades, shafting, hydraulics and a Lipstronic remote control, as well as any further accessories needed to meet the customer’s needs.

With 4- or 5-bladed propellers made of Cunial® bronze or stainless steel, ducted or non-ducted, we always have the most appropriate solution.

The range of Lips controllable pitch propellers starts at an engine power of approximately 500 kW, and a propeller diameter of 1000 mm, and in principle has no upper limit. The highest powered CPP so far absorbs 44 MW, and the largest CPP has a diameter of 9400 mm.

The Lips controllable pitch propeller is manufactured completely “in-house”. This means that they are cast, machined and assembled in either Drunen, the Netherlands, or in Rubbestadneset, Norway.

We aim to be more than just a supplier; we actively co-operate with all parties involved. The result is a controllable pitch propeller with the highest possible efficiency, limited and controlled cavitation, and low pressure pulses.

The equipment is designed for the ship’s life. And when maintenance or service is required, we offer you our worldwide service network, which operates 24 hours a day, 7 days a week.

Hydrodynamic design

Lips controllable pitch propellers are custom-designed for each ship. Each vessel has a different hull form and for that reason different wake fields. All Lips propellers are
wake-adapted and, in co-operation with the customer, both yard and owner, the propeller is designed for optimal performance in all operating conditions.

The main features of the propeller design are:
- Highest propulsive efficiency in all operating conditions
- Excellent behaviour regarding cavitation, with no erosive types of cavitation
- Lowest pressure pulse fluctuations on the hull to minimize noise and vibration levels on board.

Lips controllable pitch propellers for all ship types guarantee maximum efficiency and minimum noise and vibration levels thanks to their tailor-made design and use of the latest state-of-the-art technology:
- A special radial loading distribution is used to obtain high efficiency
- Unloading of the blade tip minimizes cavitation and pressure pulses
- Optimized blade profile sections are developed and used in the design and lead to better results regarding both cavitation behaviour and efficiency.

Wärtsilä’s design experience covers many types of ships, varying from heavy-duty vessels like hopper dredgers to high-speed passenger ferries, and from small fishing boats to enormous oil platforms carriers. Our long history of designing propellers gives us extensive hydrodynamic knowledge and we have developed our design tools based on a large number of model test results and full-scale measurements. Our research and development efforts are dedicated to continuously improving the hydrodynamic design of our propellers by:
- Co-operation with well known research institutes and universities worldwide
- Full-scale measurements
- Simulation using Computational Fluid Dynamics (CFD).

In order to fulfil the strength requirements of the propellers we perform Finite Element (FEM) analyses to check the blade strength properties of each blade design. Both fatigue strength and stresses in peak load conditions are checked.
Lips nozzles
Lips propellers can be applied for running in a nozzle. The advantage of using nozzles comes from the additional amount of thrust this develops. Various types of nozzles can be supplied, such as the standard types 19A and 37 and also the Lips HR high-efficiency nozzle. The latter delivers higher thrust (8-10%) both in bollard and sailing conditions. Taking full advantage of a Lips HR nozzle requires using a special blade design.

Lips rudders
The Lips Efficiency Rudder increases the ship's propulsive efficiency by 3-5% for twin-screw vessels and by 5-7% for single-screw vessels when compared with a conventional system. This rudder also reduces propeller-induced pressure pulses by 20-25% for twin-screw vessels and by 30-45% for single-screw vessels, while the rudder performance is at least equal to that of a conventional rudder. The use of a Lips Efficiency Rudder requires a special blade design to achieve the highest performance of the propulsion system.
When a Lips controllable pitch propeller is installed the optimum pitch setting for all possible operating conditions can be selected.

Further optional pitch settings are required and possible in the following cases:
- Manoeuvring and free-sailing mode
- Summer and winter mode (one or two engines per shaft, typically for RoRo ferries)
- Shaft generator mode
- Fouling of the engine
- Increased resistance of the ship’s hull, due to fouling
- Change of sea state and/or weather condition.

The shaft generator (PTO) with constant rpm can be installed either at the reduction gear or directly at the shaftline through a tunnel gear. A shaft generator also allows the use of a redundant propulsion system, in which case the PTO can operate as an electric motor (PTI).

For certain types of “double-duty” vessels, like tugs, trawlers and dredgers, Lips controllable pitch propellers give both better pull and higher ship speed, because adjusting the pitch makes it possible to absorb full power both at low and high ship speeds.

Finally Lips controllable pitch propellers have high manoeuvring and dynamic positioning (DP) capabilities. At low ship speeds the CPP makes more power available than the fixed pitch propeller, and astern thrust is easily achieved using only the reverse pitch setting.
D-hub Lips controllable pitch propeller systems

Features and benefits
- One-piece hub casting with integrated hub cover
  - Extra rigidity and robust construction
  - Low maintenance
- Double oil pipes
  - No water in hub in case of sterntube sealing leakage
  - Safe operation and no interference with sterntube lubrication system
- Double support of cylinder
  - Reliable and low maintenance
- Well-proven blade foot sealing system
  - No leakage of oil
  - Low maintenance
- Simple OD box mounted at forward side of gearbox or mounted in shafline
  - Reliable and low maintenance
  - Short (de)mounting length
  - Suitable for direct-driven systems and extremely long shaftlines
  - Integrated non-return valve for pitch blocking integrated into OD box for simple maintenance
- Manual emergency pitch setting in ahead condition
  - Safe operation
- Mechanical and electrical pitch feedback
  - Redundancy for safe operation
- Hydraulic flange coupling
  - Easy (de)mounting of shafting and oil pipes
  - Easy alignment of gearbox and engine
  - Reliable and safe operation
- Integrated hydraulic power pack or integrated hydraulic system mounted on gearbox
  - Easy installation and maintenance
  - Safe operation
  - Bumpless pitch control through use of proportional valve.
Single-screw RoRo vessel, cargo Spaarneborg.

D-hub in machine shop.

Propeller hub range for D-hub

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<tr>
<th>Type</th>
<th>Hub diameter</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
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E-hub Lips controllable pitch propeller systems

Features and benefits
- Streamlined hub contour
  - Reduction of fuel consumption
  - No cavitation
  - Well suited for high ship speeds
- Non-split hub casting with loose hub cover
  - Extra rigidity and robust construction
  - Low and easy maintenance
- Steel blade carriers
  - Reduction of fuel consumption due to lower propeller / hub diameter ratio and higher propeller efficiency
- Double oil pipes
  - No water in hub in case of sterntube sealing leakage
  - Safe operation and no interference with sterntube lubrication system
- Double support of cylinder
  - Reliable and low maintenance
- Well-proven blade foot sealing system
  - No leakage of oil
  - Low maintenance
- Simple OD box mounted at forward side of gearbox or mounted in shaftline
  - Reliable and low maintenance
  - Short (de)mounting length
  - Suitable for direct-driven systems and extremely long shaftlines
  - Integrated non-return valve for pitch blocking integrated into OD box for simple maintenance
- Manual emergency pitch setting in ahead condition
  - Safe operation
- Mechanical and electrical pitch feedback
  - Redundancy for safe operation
- Hydraulic flange coupling
  - Easy (de)mounting of shafting and oil pipes
  - Easy alignment of gearbox and engine
  - Reliable and safe operation
- Integrated hydraulic power pack or integrated hydraulic system mounted on gearbox
  - Easy installation and maintenance
  - Safe operation
  - Bumpless pitch control through use of proportional valve.
Twin-screw passenger ferry Pont Aven.

Propeller hub range for E-hub

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Dimensions of E-hub (in mm)

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<th>b</th>
<th>c</th>
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<td>430</td>
<td>1825</td>
<td>190 (160)</td>
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Lipstronic remote control system

The Lips controllable pitch propellers are provided with standardized electronic remote control systems covering a wide range of applications. Pitch control with constant engine speed, and combinator control with pitch and engine speed control with one lever, are available as well as load control, running-up and slow-down programmes, and also single-lever control (Lipstick). All controls comply with the latest electronics standards and the requirements for type approvals set by all classification societies.

Ship Power propulsion packages

General

A Lips controllable pitch propeller in combination with a Lips Efficiency Rudder, a Wärtsilä® gearbox and engine forms a complete propulsion package with the benefit of a single point of contact, both from the start of the newbuilding project and during the ship’s operation.

As your single point of contact we will take care of the correct interfaces and performance of the total package during the lifetime of the vessel.

Gearboxes

Wärtsilä gearboxes are often supplied in combination with Lips controllable pitch propellers. The gears are designed to meet the highest standards of operational efficiency, reliability and low noise and vibrations. Gears can be supplied with the following configurations:

- Single-input / single-output
- Twin-input / single-output
- With built-in multiclutches
- Power take-off (PTO) drives
- Auxiliary propulsion drive (APD)
- Integrated hydraulic system for gear and CPP.

Efficiency Rudder

The Lips Efficiency Rudder, an integral part of the Lips CPP concept, reduces fuel consumption, vibration and noise levels compared to traditional designs.

Accessories

To complete the propulsion package, the Lips controllable pitch propeller can be extended with the following accessories:

- Nozzles
- Deep Sea Seals & JMT seals and bearings
- Complete sterntubes
- Blocking devices
- Shaft brakes
- Earthing devices
- Torque measurement systems
- Water lubricated systems
- Special accessories on request.

As your single point of contact Wärtsilä will take care of the correct interfaces and performance of the total package.
Special features

Feathering propellers
Feathering propellers are suitable for multifunction ships which operate in such a way that one or two propellers are regularly out of use. They are typically used for sailing ships, double-ended ferries or vessels with complicated mission profiles. Wärtsilä has many years of experience with Lips feathering propellers, resulting in a design without restrictions in hydrodynamic and pitch setting capability. Lips feathering propellers can be designed to feather either via ahead or via astern pitch.

Underwater blade replacement
Blade replacement underwater is another feature unique to both the D- and E-hub. This operation can be carried out efficiently and with a minimum of equipment.
The collar-type bearing is engineered so that an extra O-ring seals the hub when the blade is removed from the blade carrier. Small valves close mechanically. These valves open again when the blade is replaced in the blade port to restore lubrication between the blade foot and hub collar. Any trapped water can escape through the valves and mix harmlessly with the lubrication oil of the hub.

Five-bladed propellers
A five-bladed propeller is possible on special request. If the natural hull frequency is equal to the four-bladed propeller frequency, the five-bladed Lips propeller offers a solution. Other reasons for applying a five-bladed Lips propeller include efficiency, noise and vibration.

Material specification

Cunial® – the Lips copper-nickel-aluminium bronze – has been developed into an excellent propeller material. Its main properties, high corrosion fatigue strength and shock strength, have resulted in applications ranging from seagoing high-speed ferries to ice breakers. Cunial® can be repaired easily at Wärtsilä service stations all over the world. Metallurgical research, knowledge and experience have all contributed to the development of Cunial®, Classification societies fully rely on the Lips advanced measuring and testing equipment needed to ascertain that the physical and mechanical properties of the material meet the required values.

Worldwide service and maintenance

Wärtsilä has a worldwide service network that assures you of reliable and efficient support and the quickest possible solution to any propulsion problem during the full operational lifetime of the vessel.
Service activities:
- Retrofits and upgrades
- Metallurgic repairs
- Modification of heavy running propellers
- Underwater service and survey
- Original Lips spare parts
- Personnel training programmes
- Helpdesk
- Worldwide field service
- In-house overhaul/repair.

Wärtsilä service: around the world, around the clock.

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Fax: +31 416 373162
Wärtsilä is The Ship Power Supplier for builders, owners and operators of vessels and offshore installations. Our own global service network takes complete care of customers’ ship machinery at every lifecycle stage.

Wärtsilä is a leading provider of power plants, operation and lifetime care services in decentralized power generation.

The Wärtsilä Group includes Imatra Steel, which specializes in special engineering steels.

For more information visit www.wartsila.com